UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2007/2008

April 2008

REG 262 – Rekabentuk Struktur
(Structural Design)

Masa: 3 jam
(Duration: 3 hours)

Sila pastikan bahawa kertas peperiksaan ini mengandungi **LAPAN** muka surat yang tercetak sebelum anda memulakan peperiksaan ini.

*Please check that this examination paper consists of **EIGHT** pages of printed material before you begin the examination.*

Pelajar dibenarkan menjawab semua soalan dalam Bahasa Inggeris ATAU Bahasa Malaysia sahaja.

Students are allowed to answer all questions either in English OR in Bahasa Malaysia only.

Jawab **LIMA** soalan.

*Answer **FIVE** questions.*

1. (a) Secara ringkas terangkan terma berikut:-

(i) Kaedah Kecacatan Kekal

(ii) Rasuk Statik Tak Tentu

Briefly explain the following terms:-

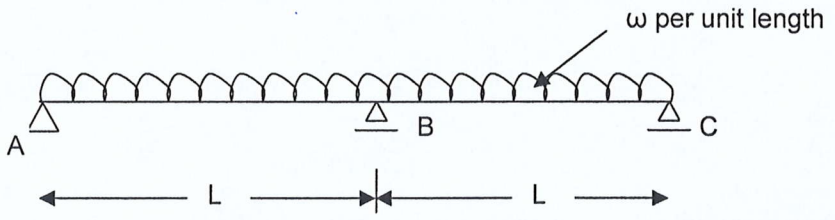
(i) Methods of Consistent Deformations

(ii) Statically Indeterminate Beams

(5 markah/*marks*)

(b) Dapatkan tindakbalas-tindakbalas untuk rasuk seperti ditunjukkan dalam **Rajah 1.0** yang mana adalah statik tak tentu dengan satu darjah (n=1)

*Find reactions the beam shown in **Figure 1.0,** which is statically indeterminate to the first degree (n=1)*



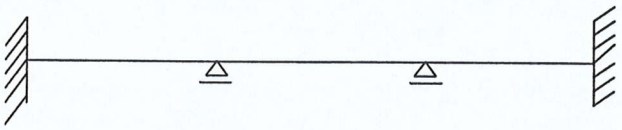
Rajah 1.0 ***(Figure 1.0)***

(15 markah/*marks*)

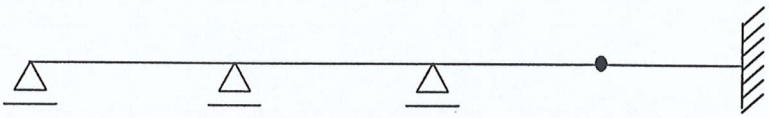
2. (a) Bincangkan tentang kestabilan dan ketentuan untuk struktur-struktur berikut. (**Rajah 2.0**)

*Discuss the stability and determinacy of the following structures. (**Figure 2.0**)*

(i)



(ii)



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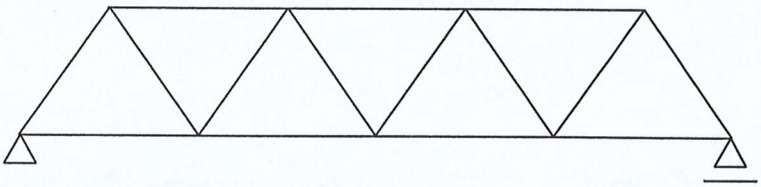
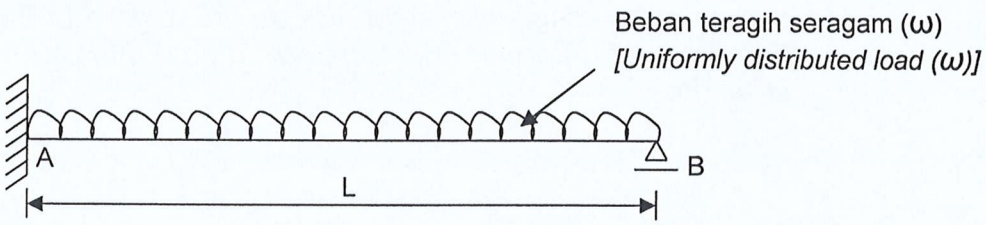


Rajah 2.0 (*Figure 2.0*)

(10 markah/*marks*)

(b) Menggunakan kaedah kecacatan kekal, dapatkan momen dan daya masing-masing pada titik A dan B.

Using the method of consistent deformation find a moment and force at point A and B respectively.

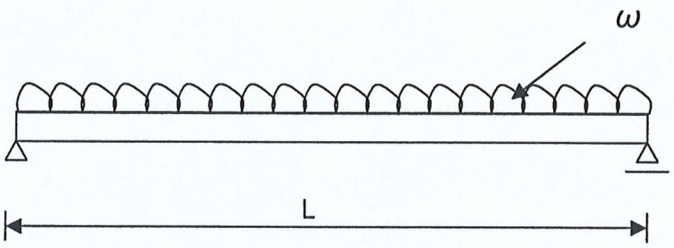


Rajah 2.1 (*Figure 2.1*)

(10 markah/*marks*)

3. (a) Kira pesongan akhir di tengah rasuk yang dikenakan beban teragih seragam.

Compute the final deflection at midspan of the beam subjected to uniformly distributed load.



Rajah 3.0 *(Figure 3.0)*

(15 markah/*marks*)

(b) Apakah perbezaan di antara kerangka ideal dan kerangka tak ideal.

What is the difference between perfect frame and imperfect frame.

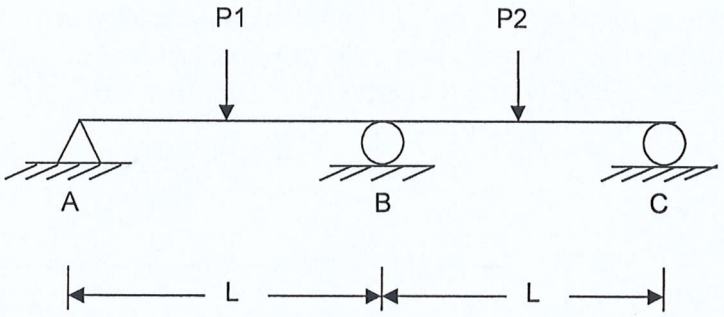
(5 markah/*marks*)

4. (a) Bincangkan tentang jenis-jenis struktur tidak boleh tentu yang terdapat dalam rekabentuk bangunan dengan menitik beratkan tentang di rajah ketidak tentuan serta jenis-jenis daya dalam dan ditupang struktur-struktur tersebut.

Discuss the various types of indeterminate structures found in the design of buildings with emphasis on the degree of indeterminacy and the type of internal and support forces that are found in these structures.

(b) Huraikan tentang pendekatan atau cara yang boleh digunakan dalam penyelesaian struktur tidak boleh tentu yang mudah seperti yang ditunjukkan dalam **Rajah 4.0.** P1 dan P2 adalah beban pada rasuk A - B - C.

Explain the method or approach that may be used to solve the simple indeterminate structure in ***Figure 4.0.*** *P1 and P2 are loads on beams A - B - C.*

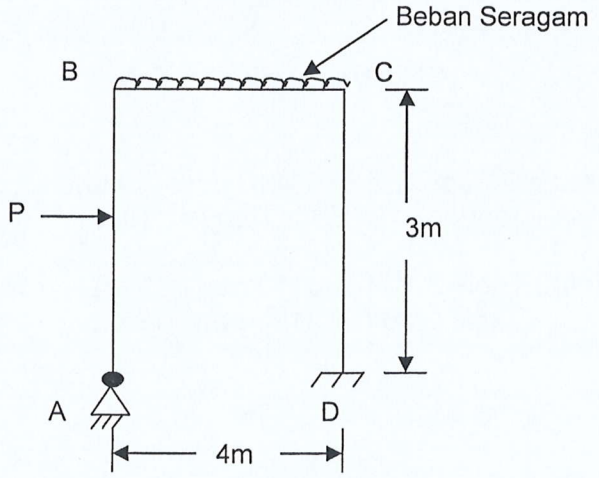


(Rajah 4.0 (*Figure 4.0)*

(20 markah/*marks)*

5. Sebuah kerangka tegar yang ditunjukkan dalam **Rajah 5.0** dibebani secara pugak oleh beban seragam bernilai 20 kN/m pada ahli BC. Jika sebuah daya mendatar P bernilai 15 kN dikenakan pada pertengahan ahli AB (1.5 m dari A), kirakan semua nilai tindakbalas di tupang D.

A rigid jointed frame shown in ***Figure 5.0*** *is vertically loaded with a uniform distributed load of 20 kN/m on member BC. If a horizontal force P with a value of 15 kN is placed in the middle of AB (1.5 m above A), calculate all the reaction forces at D.*

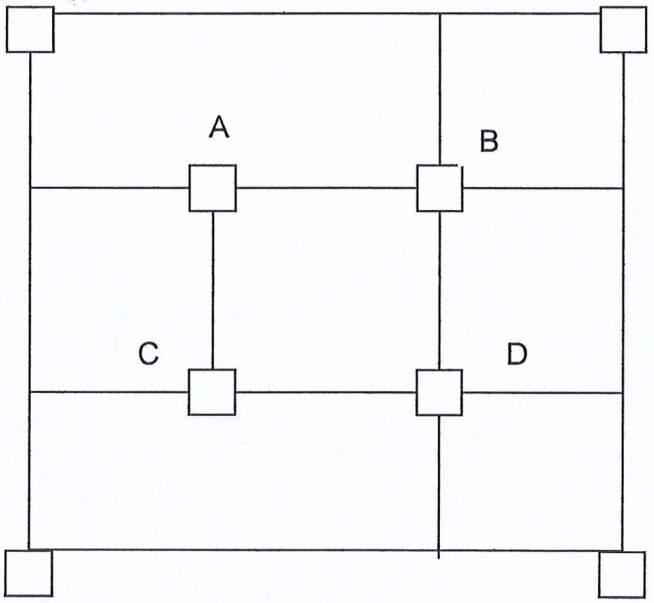


Rajah 5.0 (*Figure 5.0)*

(20 markah/*marks*)

6. Sebuah sistem lantai yang ditunjukan dalam **Rajah 6.0** diperbuat daripada konkrit bertulang dan dibebankan dengan beban hidup Qk = 1.5 kN/m^2 . Jika ketebalan lantai adalah 150mm dan berat lepaan adalah 1kN/m^2, kirakan semua momen lentur positif and negatif untuk panel lantaiA-B-C-D (AB = 3.64 m x BD = 3m) serta jumlah beban yang akan teragih kepada bahagian rasuk AB dan BD.

A reinforced concrete floor system is shown in ***Figure 6.0*** *is loaded with a live load of Qk = 1.5 kN /m^2. If the thickness of slab is 150mm and the weight of floor finish is 1 kN/m^2, evaluate the positive and negative moments arising in the slab A-B-C-D of dimensions (AB = 3.64m x BD = 3m) and the value of load transferred to beams AB and BD.)*



Rajah 6.0 (*Figure 6.0)*

Rujukan : Jadual 3.15 (BS8110:part1:1985)
Jadual 3.16 (BS8110:part1:1985)

Refer to: Table 3.15 (BS8110:part1:1985)
Table 3.16 (BS8110:part1:1985)

(20 markah/*marks*)

Table 3.15 Bending moment coefficients for rectangular panels supported on four sides with provision for torsion at corners

Type of panel and moments considered	Short span coefficients, β_{sx}								Long span coefficients, β_{sy}, for all values of l_y/l_x
	Values of l_y/l_x								
	1.0	1.1	1.2	1.3	1.4	1.5	1.75	2.0	
Interior panels									
Negative moment at continuous edge	0.031	0.037	0.042	0.046	0.050	0.053	0.059	0.063	0.032
Positive moment at mid-span	0.024	0.028	0.032	0.035	0.037	0.040	0.044	0.048	0.024
One short edge discontinuous									
Negative moment at continuous edge	0.039	0.044	0.048	0.052	0.055	0.058	0.063	0.067	0.037
Positive moment at mid-span	0.029	0.033	0.036	0.039	0.041	0.043	0.047	0.050	0.028
One long edge discontinuous									
Negative moment at continuous edge	0.039	0.049	0.056	0.062	0.068	0.073	0.082	0.089	0.037
Positive moment at mid-span	0.030	0.036	0.042	0.047	0.051	0.055	0.062	0.067	0.028
Two adjacent edges discontinuous									
Negative moment at continuous edge	0.047	0.056	0.063	0.069	0.074	0.078	0.087	0.093	0.045
Positive moment at mid-span	0.036	0.042	0.047	0.051	0.055	0.059	0.065	0.070	0.034
Two short edges discontinuous									
Negative moment at continuous edge	0.046	0.050	0.054	0.057	0.060	0.062	0.067	0.070	–
Positive moment at mid-span	0.034	0.038	0.040	0.043	0.045	0.047	0.050	0.053	0.034
Two long edges discontinuous									
Negative moment at continuous edge	–	–	–	–	–	–	–	–	0.045
Positive moment at mid-span	0.034	0.046	0.056	0.065	0.072	0.078	0.091	0.100	0.034
Three edges discontinuous (one long edge continuous)									
Negative moment at continuous edge	0.057	0.065	0.071	0.076	0.081	0.084	0.092	0.098	–
Positive moment at mid-span	0.043	0.048	0.053	0.057	0.060	0.063	0.069	0.074	0.044
Three edges discontinuous (one short edge continuous)									
Negative moment at continuous edge	–	–	–	–	–	–	–	–	0.058
Positive moment at mid-span	0.042	0.054	0.063	0.071	0.078	0.084	0.096	0.105	0.044
Four edges discontinuous									
Positive moment at mid-span	0.055	0.065	0.074	0.081	0.087	0.092	0.103	0.111	0.056

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Table 3.16 Shear force coefficients for uniformly loaded rectangular panels supported on four sides with provision for torsion at corners

Type of panel and location	β_{vx} for values of l_y/l_x								β_{vy}
	1.0	1.1	1.2	1.3	1.4	1.5	1.75	2.0	
Four edges continuous									
Continuous edge	0.33	0.36	0.39	0.41	0.43	0.45	0.48	0.50	0.33
One short edge discontinuous									
Continuous edge	0.36	0.39	0.42	0.44	0.45	0.47	0.50	0.52	0.36
Discontinuous edge	–	–	–	–	–	–	–	–	0.24
One long edge discontinuous									
Continuous edge	0.36	0.40	0.44	0.47	0.49	0.51	0.55	0.59	0.36
Discontinuous edge	0.24	0.27	0.29	0.31	0.32	0.34	0.36	0.38	–
Two adjacent edges discontinuous									
Continuous edge	0.40	0.44	0.47	0.50	0.52	0.54	0.57	0.60	0.40
Discontinuous edge	0.26	0.29	0.31	0.33	0.34	0.35	0.38	0.40	0.26
Two short edges discontinuous									
Continuous edge	0.40	0.43	0.45	0.47	0.48	0.49	0.52	0.54	–
Discontinuous edge	–	–	–	–	–	–	–	–	0.26
Two long edges discontinuous									
Continuous edge	–	–	–	–	–	–	–	–	0.40
Discontinuous edge	0.26	0.30	0.33	0.36	0.38	0.40	0.44	0.47	–
Three edges discontinuous (one long edge continuous)									
Continuous edge	0.45	0.48	0.51	0.53	0.55	0.57	0.60	0.63	–
Discontinuous edge	0.30	0.32	0.34	0.35	0.36	0.37	0.39	0.41	0.29
Three edges discontinuous (one short edge continuous)									
Continuous edge	–	–	–	–	–	–	–	–	0.45
Discontinuous edge	0.29	0.33	0.36	0.38	0.40	0.42	0.45	0.48	0.30
Four edges discontinuous									
Discontinuous edge	0.33	0.36	0.39	0.41	0.43	0.45	0.48	0.50	0.33

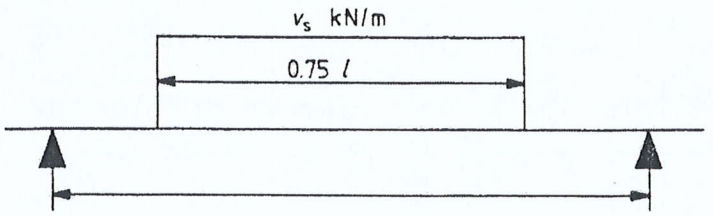

Figure 3.10 Distribution of load on a beam supporting a two-way spanning slab

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